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TO:MR. DAVID CROXTON
U.S.EPA, REGION 10
1200 SIXTH AVE., HW 112
SEATTLE, WA. 98101

From:Robert S. Farrell
Box 462, RFD 1
Augusta, Maine 04330

REF: CHEMPRO-PIER 91, DRAFT WORK PLAN

USEPA RCRA
3012463

Box 462, RFD 1
Augusta, Maine 04330
November 23, 1990

Mr. David Croxton
U.S. EPA, Region 10
1200 Sixth Ave., HW 112
Seattle, WA 98101

REF: Review of Draft Work Plan, Chempro Pier 91,
September 4, 1990

[illegible]r Mr. Croxton:

The September, 1990 draft work plan appears to have been based on the April 24, 1989 Hydrogeologic Investigation of the Pier 91 facility. In order to evaluate the draft work plan it was necessary to evaluate the earlier hydrogeologic investigation. The April, 1989 investigation does not present an adequate discussion of the local hydrogeology for what should be expected in the hydrogeologic setting for where the Pier 91 facility is located. No discussion is made of how the data that is collected during the investigation fits the expected results [illegible] the site's location. The site is located in a lowland [illegible] Queen Anne Hill on the east and Magnolia Hill on the [illegible] is located less than 400 feet from the ocean. It should be expected that the area would be one of ground water discharge. Deeper ground water should have higher head than shallower ground water.

Three stratigraphic units are defined in the April, 1989 report. There is an upper sand and gravel unit that is indicated to be fill. Below this a silty sand unit believed to be the original surface of the cove that was filled. Below is a sand to gravelly sand unit. This lower unit is not laterally continuous and appears to be replaced by a silt unit just north of the facility. The silty sand layer is called an aquitard that separates the ground water in the upper sand layer from the ground water in the lower sand layer. No basis is presented in the April, 1989 investigation for calling this silty sand layer an aquitard. No sieve analyzes, pump tests, slug tests, nor other basis is presented which demonstrates that this unit is an aquitard. The report claims that one well (CP-105B) was completed and tested in this aquitard. The boring log indicates that this well was completed in a silt layer at the same elevation as the other wells in the lower sand unit. The hydraulic conductivity testing for this one well gave similar results as wells CP 103A (shallow), CP 103B (deep), CP 104B (deep), CP 106 (shallow), and CP 109 (shallow). Of the 12 slug tests shown on table 3-1, six are the same order of magnitude as CP 105B. Outside of observational data from the boring logs there is no supporting data for the definition of the silt sand layer as an aquitard.

This aquitard is of critical importance in understanding the ground water flow at this site. If it is a legitimate barrier to ground water flow vertically, then it should prevent vertical migration of contaminates and should result in a considerable cost savings in the volume of ground water that has to be cleaned up. At a minimum a contour map of the upper surface of the aquitard should have been prepared. This surface has the potential to control the spread of DNAPLs, change the ground water velocity as the upper aquifer thins and thickens, and change the direction of ground water flow. Attached figure 1 is a contour map of the upper surface of the silty sand layer. The most important feature is a four to 5 foot drop in the surface that runs north/south down the west side of the facility. The change in elevation of the bottom of the upper aquifer from -15 to -10 feet should have a significant impact on the velocity of ground water on either side of the escarpment.

Attached figure 2 is a contour map of the March [illegible] data for the shallow aquifer. There is a doubling of [illegible] between wells 106 and 109 and wells 109 and 107 [illegible] in accord with what should be expected if the thic[illegible] aquifer is decreased by half. To move the same volume [illegible] requires the doubling of the ground water [illegible] [illegible]. Since Q, K, and n are constants, [illegible] [illegible] area becomes smaller, only i can increase.

[illegible]ange in velocity does not demonstrate [illegible] [illegible] an aquitard but, it is consistent with [illegible]. The tests that are normally performed to de[illegible] [illegible] an aquitard have not been done. Pump tests [illegible] [illegible]ed to determine the amount of interconnection [illegible] [illegible] sand layer. Hydraulic conductivity tests should [illegible] performed in situ. The [illegible] in situ hydraulic conductivity [illegible] that was claimed [illegible] have been performed on the aquitard [illegible] 105D) is of ques[illegible]ble validity for demonstrating that [illegible]ty sand layer is an aquitard.

The April, 1989 hydrogeologic investigation report does [illegible] [illegible] have attached any significance to the [illegible] [illegible]ward vertical gradient between the upper sand aquifer [illegible] deeper sand aquifer. Given the geologic setting, vertical downward gradients do not make sense unless ground water withdrawal is occurring. This downward gradient has to be considered in [illegible] of the much higher specific conductivities that are measured in the lower aquifer wells than in the shallow aquifer wells. These higher specific conductivities suggest salt water intrusion into the deeper aquifer. Again this suggests that pumping is occurring in this area.

Well 105B is indicated as being in the silty sand aquitard. The boring log indicates that the lower half of the well screen is in a silt layer and the wells completion elevation is consistent with that of the other three wells that were completed in the lower sand aquifer. The hydrologic data for this well is not consistent with a well that has been completed in a silt layer or an aquitard. First, as was pointed out above, the hydraulic conductivity for this well is not significantly different from many other wells completed in the sand and gravel units as to suggest a different sedimentary material or unit. If this well were completed in a silt layer or in an aquitard, there should have been a significantly lower hydraulic conductivity than the upper sand and lower sand aquifers. Second, the silt layer or aquitard should have resulted in a lower ability to transmit ground water. This lower ability to transmit water should have resulted in higher gradients between the wells located horizontally at the same elevation (ie. lower sand aquifer wells). This is not the case. The horizontal gradient for the February, 1989 data indicates that the gradient between 105B and 104B is half the gradient between 104B and 103B. This is the reverse of what should be expected.

Many of the wastes that have been reported in the ground water have the potential for forming DNAPLs. Given the shape of the top of the silty sand layer and its possible control on the direction of movement of a DNAPL, only well 109 is located horizontally so as to detected a DNAPL if one were present; however, the screen for well 109 is located 5 feet above the top of the silty sand layer. The result is that nothing is known about the presence of DNAPLs.

The monitoring wells are constructed so that they have water tight caps. The problem with such construction is that water tight usually means air tight so that the wells are not vented. This is not a serious problem for water table wells where the screening is above the water table allowing venting from the well into the vadose zone. On wells with screening below the water table there is no way for the changes in water pressure to be vented. Significant water elevation errors may result.

PROPOSAL-September 4, 1990

The proposal consists of installing 10 new wells with soil sampling and testing (eight wells 15 feet deep and two 20 feet deep), sampling the water quality in all wells once, and taking two rounds of water level measurements (pg c-6). Three of the proposed wells are to define the extent of the plume (111, 112, and 113). The remaining wells are internal to the contaminated area or upgradient (well 114). From the conceptual model of the site that is presented in the April, 1989 investigation the location and depth of wells is reasonable. As the review of the April, 1989 report has shown, there are numerous questions

contaminate
requiring answers about the site's hydrogeology and
distribution.

On figure C-1 of the proposal a series of W wells are shown.
No data is provided about these wells nor what was detected from
their sampling or water levels. A Lake Jacobs is shown. Obviously
this is a manmade pond of some kind, but some information has to
be provided about its water budget and its construction. This is
particularly important in light of the tidal influence that has
been shown for wells 103 and 108. It is important to the ground
water flow in the upper sand aquifer to define the water budget
of this pond. It must be known what the source of water is for
the pond and how it influences ground water flow around the pond.
The change in flow direction from north to west shown on attached
figure 2 suggests that leakage is occurring from the pond to the
ground water. In all probability Lake Jacobs is a fire control
pond. If so, it is possible for contaminates to discharge to the
pond under various seasonal and operational conditions.

Three or four deep aquifer wells are not sufficient to
define the ground water flow nor the degree of contamination in
the lower aquifer. Additional wells are necessary in the lower
aquifer.

Based on the information contained in the April, 1989
investigation, no additional shallow aquifer wells are
recommended beyond those proposed in the work plan. It is
important that the wells that are interior to the plume be
constructed so that they are capable of detecting DNAPLs if they
are present.

Testing needs to be done to demonstrate the degree of
interconnection between the upper sand aquifer and the lower sand
aquifer. This can only be done through the proper use of pump
testing for vertical and horizontal interconnections between the
wells. It is particularly important to determine the hydraulic
properties of the silty sand layer and the silt layer through
actual field testing and pump tests. The relationship of well
105B to the other wells has to be understood in light of the
conflict in the observations of silt in the boring log and the
inconsistent hydraulic conductivity and gradients that are
observed at the well.

Part of the investigation should include a determination of
why the relationship between the upper and lower aquifers is
reversed from that which should be expected in a ground water
discharge area. Part of this investigation should include an
inventory of uses that are being made in the facility area of the
ground water. Further, since there are numerous manmade
structures near the facility such as piers, bulkheads, sheet
pilings, utility conduits, etc. that could influence the
direction of ground water flow, an inventory should be made of

these features and a determination of their impact on ground water flow and contaminate migration is needed.

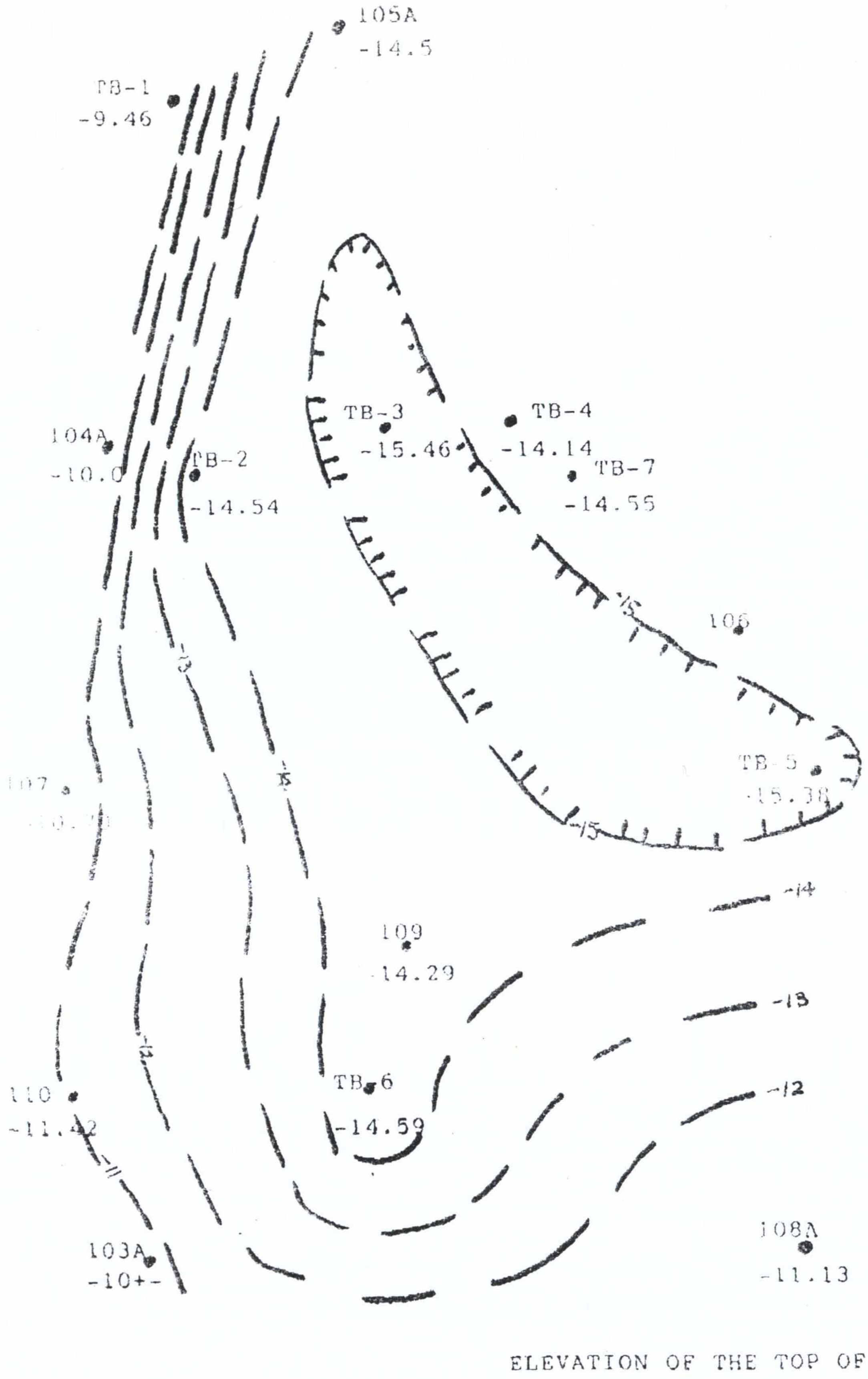
Just one sampling or two water level measuring events is not sufficient to understand the seasonal changes that are possible in this aquifer. A regular sampling and monitoring program has to be established that is consistent with site's hydrogeology. At a minimum monthly water levels should be collected for at least a year. Quarterly water quality samples should be taken. After at least a year's amount of data and the various testing that is recommended, then modifications to the sampling and analysis plan should be considered.

It is unlikely that the proposed three wells to define the limits of the plume will actually define the limits of the plume. This will be for two reasons. If the wells detect contamination it will be clear that additional wells will be necessary to define the full extent of the plume. If the wells are clean then there are not enough wells to know if the plume has been missed because the direction of plume migrations is different than that predicted or that the plume actually has not migrated this far at this time. Planning should be initiated for both of these possibilities.

Sincerely,

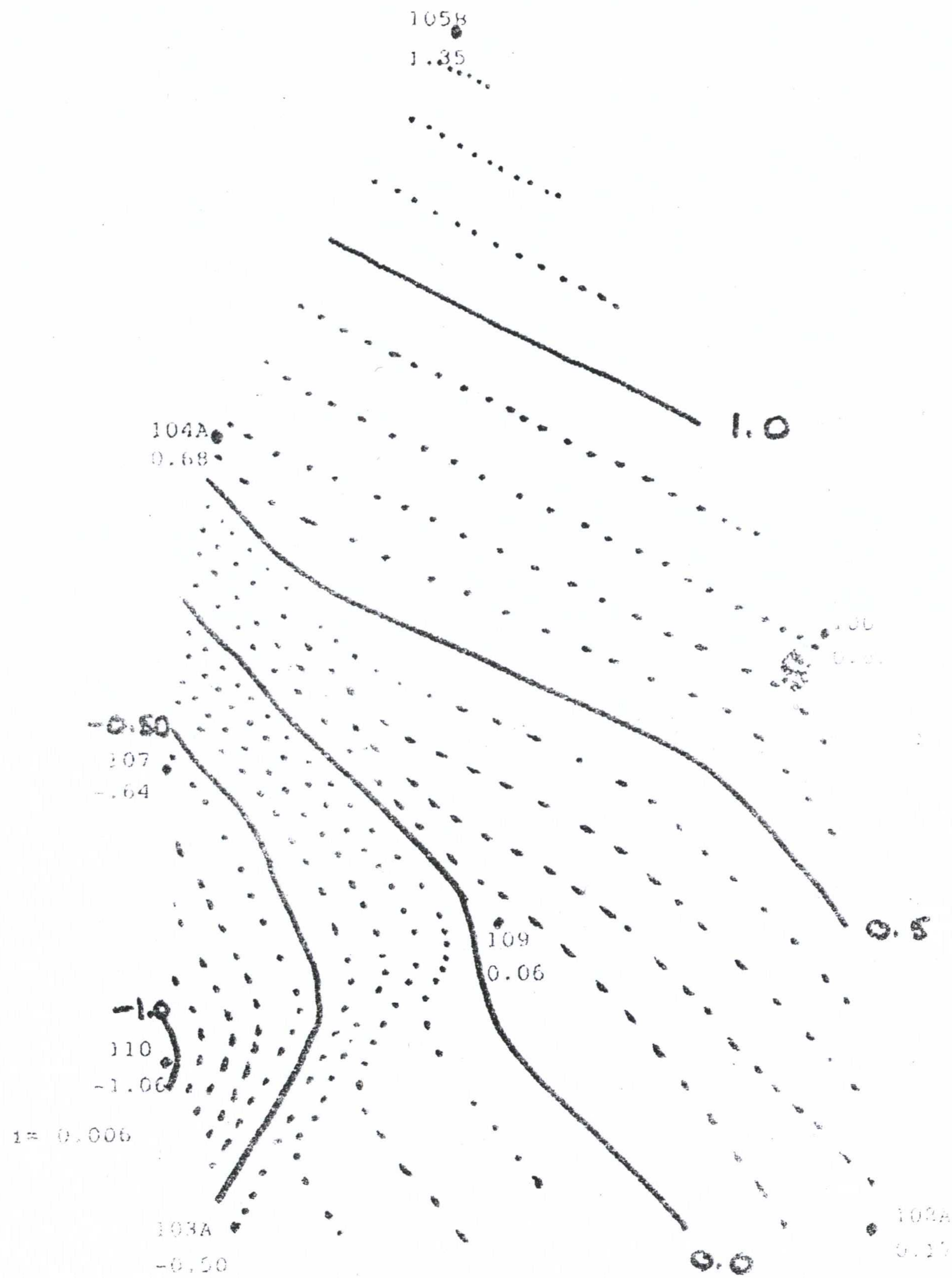
Robert S Farrell

Robert S. Farrell
Consultant



ELEVATION OF THE TOP OF THE
SILTY SAND LAYER

FIGURE 1



UPPER SAND AQUIFER CONTOUR MAP

MARCH 1, 1989

FIGURE 2